

# 2023 ANNUAL REPORT

Revive & Restore  
On the move...

revive & restore  
GENETIC RESCUE OF ENDANGERED  
AND EXTINCT SPECIES





## Dear Friends & Supporters,

I had the privilege to go on safari in Tanzania this year, and riding in a hot air balloon gave me a wonderful perspective on what biodiversity and bioabundance really means. Looking down from above, I witnessed the Great Migration through Serengeti National Park, one of the most spectacular animal migrations in the world. Thousands of wildebeests, zebras, and their various predators and scavengers were all on the move as they sought greener, more nutritious grass across the plains.

This incredible sight speaks to the heart of the mission of Revive & Restore— to revive species that are endangered and restore ecosystems to a healthy level of biodiversity and bioabundance. And because small, fragmented populations are more vulnerable to wildlife disease, loss of genetic diversity, and climate change, **this is the focus of our work at Revive & Restore.**

In 2023, to address these challenges, Revive & Restore pushed the boundaries of conservation and spearheaded groundbreaking research—all to bring positive change for our planet. The pages that follow offer an overview of the milestones we've achieved together and the impact your support can have on wildlife.

Looking ahead to 2024, we are filled with enthusiasm for the possibilities that lie before us. With your ongoing support, we can build on our achievements and approach new wildlife conservation challenges with determination and innovation. We look forward to the continued impact we can make together in the coming year.



*Ryan Phelan Stewart Brand*

**Ryan Phelan and Stewart Brand**  
Co-Founders of Revive & Restore

**Ryan Phelan**  
Serengeti National Park, Tanzania 2023

[Donate online today!](#)

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Ryan on stage at the Long Now Foundation, following her 2023 seminar "Bringing Biotech to Conservation" | Photo: Christopher Michel



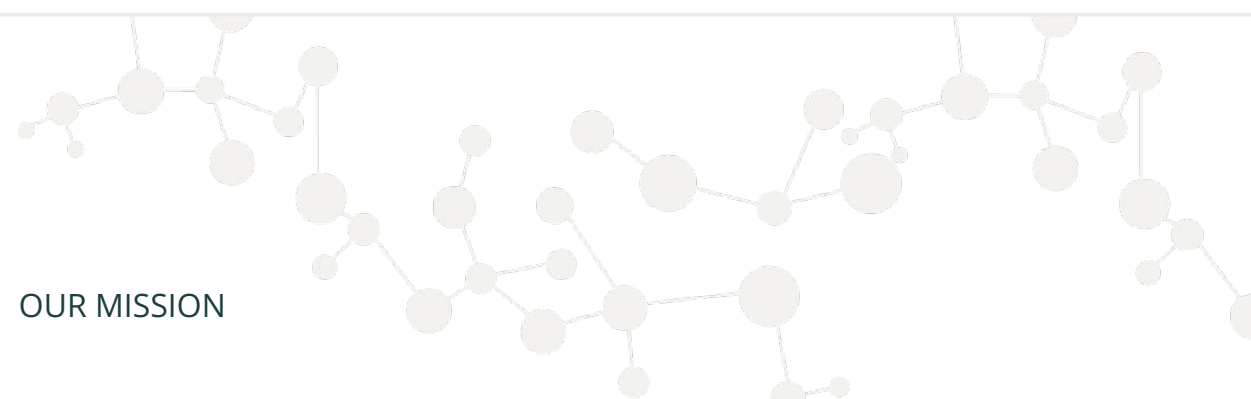
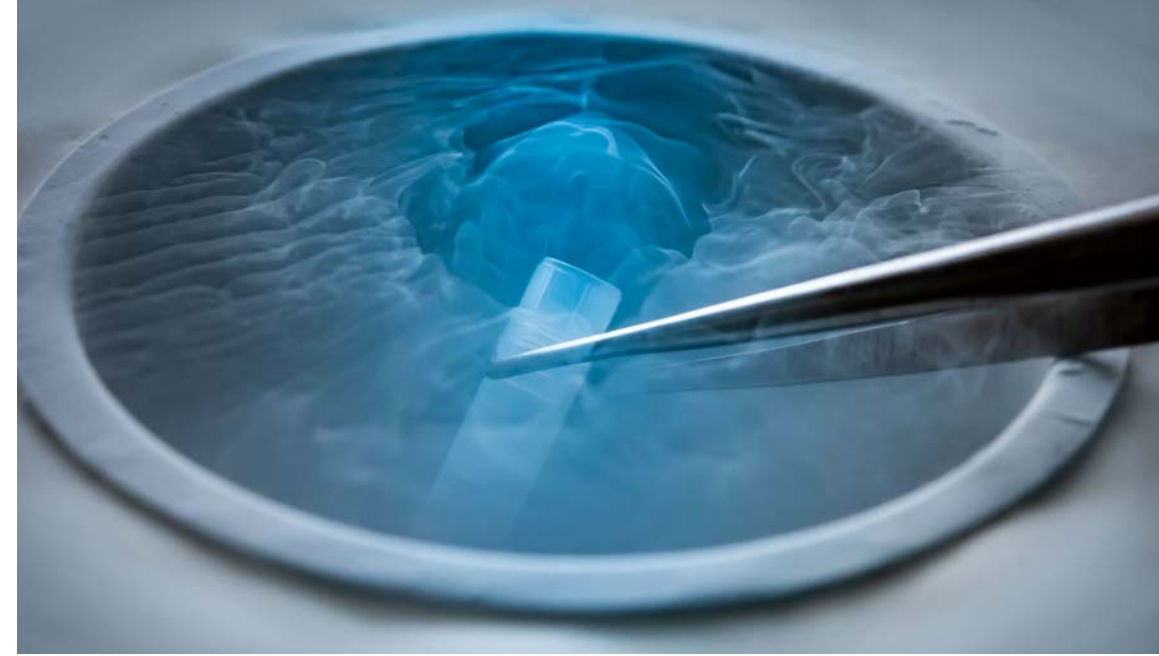
# Revive & Restore Is On A Bold Mission

**To enhance biodiversity through the genetic rescue of endangered and extinct species.**

To advance our mission, we are building the Genetic Rescue Toolkit, a suite of biotechnologies to help solve global biodiversity challenges. The projects we initiate and fund are often the first to demonstrate the measurable impact biotechnology can have on wildlife conservation.

We apply a unique, three-pronged approach to innovation by convening partners, advancing technology solutions, and funding proof-of-concept research – all to build a better future for wildlife

**Our vision is to revive biodiversity and restore ecosystems for millennia to come.**



OUR MISSION







# In 2023, Our Genetic Rescue Projects Help Mitigate Global Wildlife Challenges



INVASIVE SPECIES



WILDLIFE DISEASE



GENETIC DIVERSITY LOSS



CORAL BLEACHING



WILDLIFE POACHING



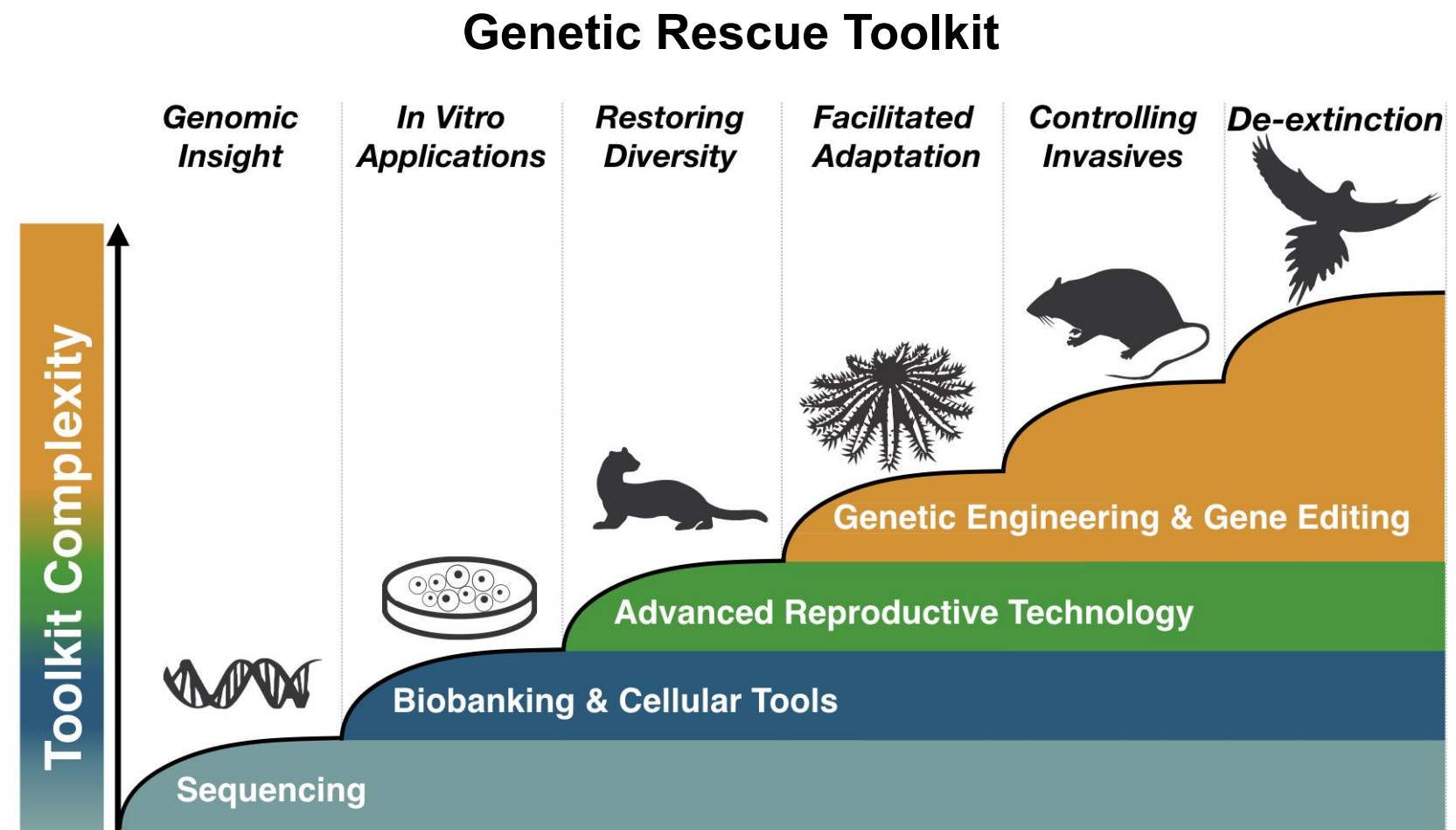
CLIMATE CHANGE

# How We Do It: Our Genetic Rescue Toolkit

As threats to wildlife increase with the pace of climate change, so too must our conservation strategies.

Our Genetic Rescue Toolkit is a suite of biotechnology tools with direct conservation applications, designed to turn the tide on biodiversity loss. They are building blocks for genetic rescue in wildlife.

By advancing the Genetic Rescue Toolkit, we are laying the foundation for unprecedented conservation strategies to tackle unprecedented conservation challenges.



*From bottom to top, these biotechnologies form the building blocks of genetic rescue. Sequencing and biobanking, for example, are foundational tools that enable more advanced technologies, like cloning and genetic engineering.*



## GENETIC RESCUE TOOLKIT: GENOME SEQUENCING

# Sequencing Provides Insight For Genetic Rescue

By decoding the DNA of species, genome sequencing reveals a deeper understanding of their potential for climate adaptation, disease resistance, reproductive potential, and long-term survival. Genome sequencing is a foundational tool for building evidence-based strategies for genetic rescue in wildlife species.

**Here at Revive & Restore, we use genome sequencing to build baselines for our genetic rescue efforts.**

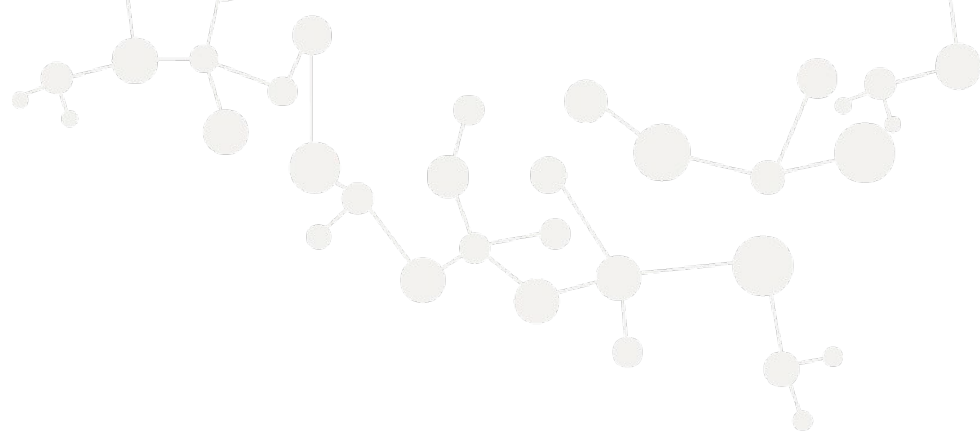
This year, we announced two new cohorts of [Wild Genomes](#) awardees, in partnership with Morris Animal Foundation, bringing the portfolio up to 32 projects applying genome sequencing to conservation. Wild Genomes is a global funding program for applied sequencing projects. This year's awardees had two focal areas: amphibians and kelp forest ecosystems.

Through [Wild Genomes](#), we promote the use of genome sequencing to build solutions for on-the-ground conservation challenges.



In 2023, we funded 8 projects focused on kelp forests, including Dr. Samuel Starko at the University of Western Australia. Dr. Starko will sequence and assemble genomes from two brown seaweed species to inform management strategies.





**“Morris Animal Foundation is truly grateful for the opportunity of continued partnership with Revive & Restore. Through the combined efforts of our teams, we are making a meaningful difference in the well-being of wildlife and their fragile ecosystems.”**

DR. KATHY TIETJE  
CHIEF PROGRAM OFFICER AT MORRIS ANIMAL FOUNDATION  
WILD GENOMES PARTNER



Sage Ono



## GENETIC RESCUE TOOLKIT: BIOBANKING

# Biobanking Builds The Foundation For Genetic Rescue

By preserving living cells, biobanking offers a safeguard for the genetic diversity of vulnerable species. Biobanking also provides a foundation for more advanced genetic rescue technologies and can reveal genetic strategies to mitigate disease and climate change. Our goal is to make biobanking standard practice in conservation to protect genetic diversity before it's lost.

In 2023, we launched a [groundbreaking initiative to biobank U.S. endangered species](#), in partnership with U.S. Fish & Wildlife Service. As a proof of concept, we set a bold objective to sequence and biobank cell lines for 25 U.S. endangered mammals, and we are nearing completion as we close out 2023. Along the way, we streamlined the biobanking process so that practitioners everywhere can integrate it into their workflows.

Biologist Robert Schorr assesses the health of an endangered Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*) before taking a sample for our biobanking program.





**“21st century conservation challenges require 21st century conservation tools. Biobanking is one such tool that allows us to preserve some of the biodiversity that exists today and ensure it isn’t lost forever.”**

SETH WILLEY  
DEPUTY ASSISTANT, REGIONAL DIRECTOR OF ECOLOGICAL SERVICES  
US FISH & WILDLIFE SERVICE



In 2023, we biobanked cells from this female Mexican Wolf (*Canis lupus baileyi*) to preserve her genetic diversity | Rebecca Bose



## 2023 Breakthrough: New Technique To Biobank Coral

“At a time when climate change is moving so fast, this gives us an amazing ability to stop time here in the 2020s.”

DR. E MICHAEL HENLEY, CO-PI

In 2023, a team of scientists, funded by Revive & Restore, developed the first successful technique for cryopreserving and reviving entire coral fragments. The technique is a breakthrough in the fight to protect the world’s coral reefs from climate change.

The new cryopreservation method opens the door to collecting and preserving coral fragments easily and rapidly at an urgent moment for coral worldwide.

“Our goal is to cryopreserve as many species of coral as possible by 2030,” explains Dr. E Michael Henley, one of the project leads.

This breakthrough was achieved by Mary Hagedorn and E. Michael Henley, research scientists at the Smithsonian’s National Zoo and Conservation Biology Institute, and colleagues Matt Powell-Palm, from Texas A&M University and Boris Rubinsky at the University of California, Berkeley.



Dr. Mary Hagedorn and student cryopreserve a coral fragment | Smithsonian



GENETIC RESCUE TOOLKIT: ADVANCED REPRODUCTIVE TECHNIQUES

# Cloning offers a second life for lost genes

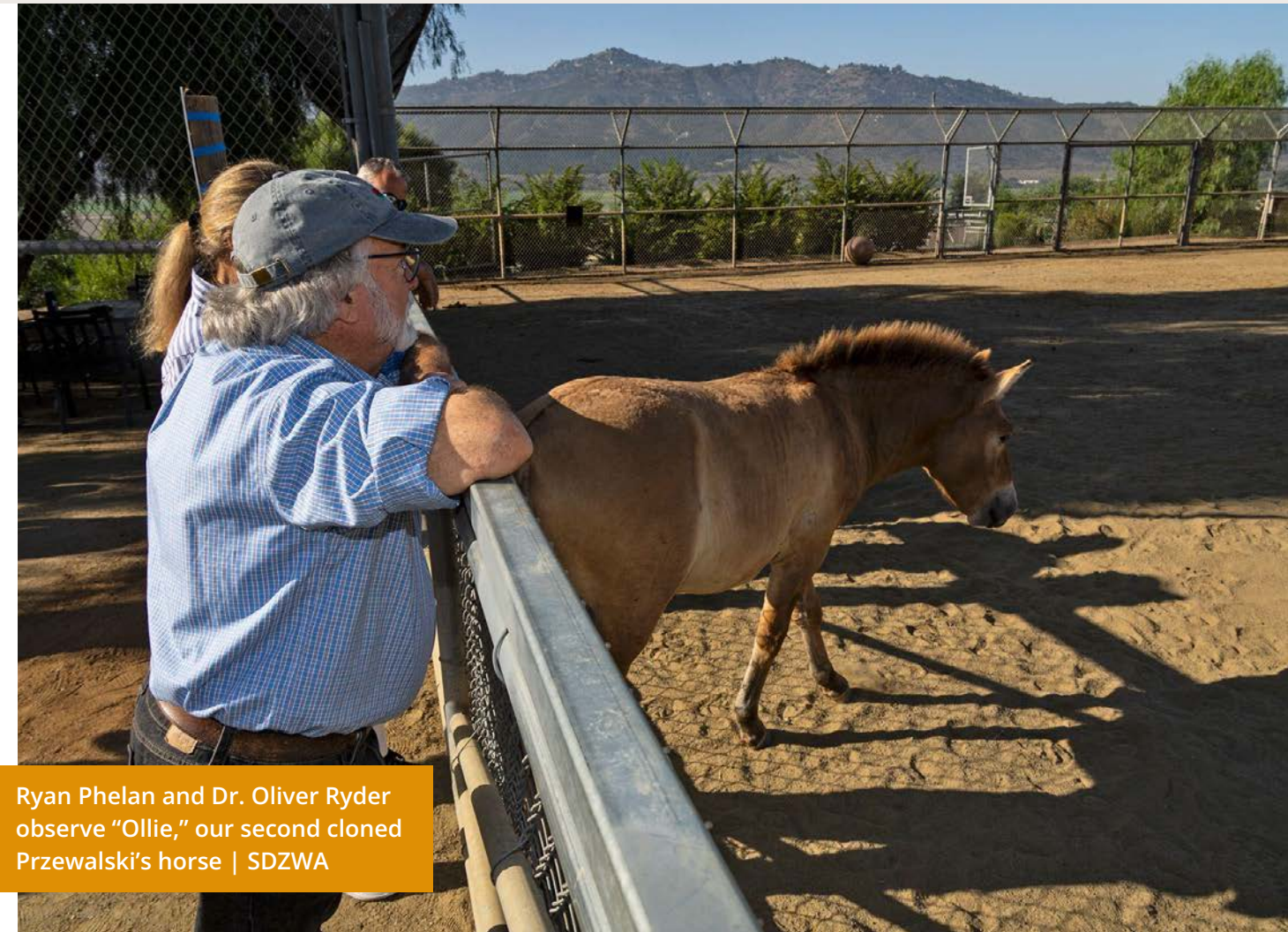
**“The most transformative moments in conservation happen when the brightest minds collaborate and discover new possibilities for wildlife”**

DR. PAUL A. BARIBAULT,  
PRESIDENT AND CHIEF EXECUTIVE OFFICER, SAN DIEGO ZOO WILDLIFE ALLIANCE

When a species declines toward extinction, it loses genetic diversity accumulated over eons through evolution. But using reproductive technologies, like cloning, conservationists can reach into the past and recover that lost genetic diversity. When clones grow up and reproduce, it is a literal second life for lost genes.

In 2023, Revive & Restore and its partners welcomed a [second cloned Przewalski's horse](#), named “Ollie” in honor of Dr. Oliver Ryder at the San Diego Zoo Wildlife Alliance’s Frozen Zoo. Ollie’s birth is a historic milestone, marking the first time EVER that a second viable clone of an endangered species was produced.

Ollie’s birth provides evidence that cloning has become an increasingly viable tool for genetic rescue in endangered species.



Ryan Phelan and Dr. Oliver Ryder observe “Ollie,” our second cloned Przewalski’s horse | SDZWA





**“Revive & Restore is an invaluable partner in our genetic preservation and cloning efforts. The list of accomplishments is impressive today, but we are only beginning to see the benefits that we can create together. We share a bold vision for using proven technology for positive change.”**

BLAKE RUSSELL  
PRESIDENT OF VIAGEN PETS & EQUINE



ViaGen President Blake Russell with 5-day-old Ollie, our second cloned Przewalski's horse. In 2023, Ollie marked the first time an endangered species had been cloned twice | Elizabeth Arrellano



## GENETIC RESCUE TOOLKIT: STEM CELL TECHNOLOGIES

# Stem Cells Are The Future Of Genetic Rescue

Stem cells are like a blank canvas – pliable cells that can be programmed to become any type of cell in the body. They are simple to cryopreserve and replicate indefinitely. Stem cells allow biobanks to transform tissue samples into a limitless supply of valuable biological material, like sperm and eggs.

In 2023, we hosted a [global workshop to accelerate stem cell technologies for wildlife conservation](#). Over three days in an intensive workshop-meets-conference format, 45 leaders from across science, industry, zoos and conservation met to reimagine the future of stem cell technologies for wildlife.



This year, we hosted 45 leaders from across science, industry, and conservation to advance stem cell technologies for wildlife. This workshop was the first of its kind for stem cell technologies.





**“Harnessing the power of stem cells will be a gamechanger for wildlife conservation. Revive & Restore is driving this work forward with the world’s first official Stem Cell Program for Wildlife Conservation”**

ASHLEE HUTCHINSON  
PROGRAM MANAGER, STEM CELL RESEARCH FUND  
2023 STEM CELL WORKSHOP ORGANIZER



**“This was a phenomenal workshop. I’ve met so many amazing people and had amazing conversations, so thank you. I would love to support Revive & Restore to help take it over the line, get the funders, find the people, and make it a reality.”**

SUZANNAH WILLIAMS  
NATURE’S SAFE AND OXFORD UNIVERSITY  
2023 STEM CELL WORKSHOP PARTICIPANT



## 2023 Workshop: Advancing Stem Cell Technologies For Wildlife Conservation

Our [2023 Stem Cell Workshop](#) provided a 3-day intensive event for 45 global participants. The event featured a range of talks designed to expose participants to diverse applications for stem cell technology within conservation.

During the event, participants were divided into 3 teams and tasked with the creation of a single 'Big Idea' to change the future of conservation via stem cell technologies. Each team presented their Big Idea on the last night of the event.

Currently, we are fundraising to actualize the Big Ideas that were conceived during the workshop. In 2023, we received over \$100,000 to kickstart our Stem Cell Research Fund.

Thanks to our incredible team for all of the work to coordinate and execute the conference.

### SPECIAL THANKS TO OUR WORKSHOP SPONSORS

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Pershing Square Foundation  
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San Diego Zoo Wildlife Alliance

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ViaGen Pets & Equine



Workshop participants were invited on a private tour of the San Diego Zoo Safari Park and Frozen Zoo. From left: Pete Miraglia, Bridget Baumgartner, Oliver Ryder, Sean Walker, Ryan Phelan.



# Meet The Team Behind The Science



RYAN PHELAN  
EXECUTIVE DIRECTOR



PETE MIRAGLIA  
DEPUTY DIRECTOR



BRIDGET BAUMGARTNER  
DIRECTOR OF R&D



BEN NOVAK  
LEAD SCIENTIST



ASHLEE HUTCHINSON  
PROGRAM MANAGER



LIV WILLIAMSON  
PROGRAM MANAGER



MARMEE MANACK  
DIRECTOR OF OPERATIONS



KIKA TUFF  
DIRECTOR OF COMMUNICATION



TRACI ECKELS  
GRANTS MANAGER



TIFFANY ROSSO  
DIRECTOR OF DONOR STRATEGY

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- SVEN BUERKI  
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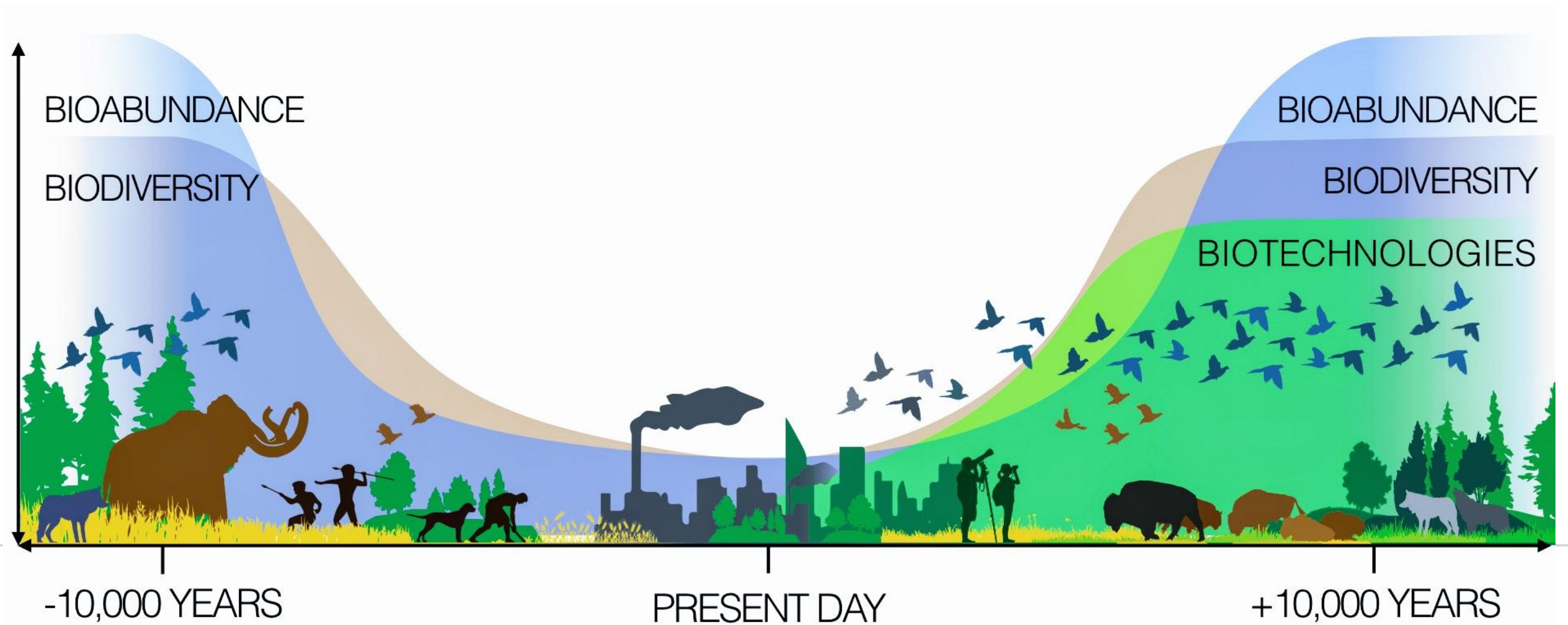
**“It’s an honor to support an organization so effectively devoted to developing answers to the environmental challenges that we face and to preserving the diversity of the species with which we live and on which we depend. Revive & Restore’s continued progress is both a comfort and an inspiration.”**

LAWRENCE WILKINSON  
RECURRING DONOR TO REVIVE & RESTORE





# Our goal over the next 2 years: Raise \$10 Million To Help Turn The Tide On Biodiversity Loss





# Please Consider Making Your Tax-Deductible Donation Today To Help Change The Future Of Conservation

Revive & Restore is a 501(c)3 non-profit  
Charity Navigator Score 100



[Donate online today!](#)

